

In This Issue ...

- ◆ Activated Sludge Technology
- ◆ Wastewater Treatment Technician Wanted
- ◆ Funding Available for Drinking Water Operators
- ◆ Asset Mgmt. Workshops
- ◆ DNR Develops RMI
- ◆ EMS Training/Implementation
- ◆ Document Distribution Services
- ◆ Training Schedule

Water & Wastewater Digest

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May/June 2004

Title 10 – DEPARTMENT OF NATURAL RESOURCES Division 20 – Clean Water Commission Chapter 9 – Treatment Plant Operations 10 CSR 20 – 9.010 Wastewater Treatment Systems Operation Scope Monitoring

PURPOSE: This regulation sets forth the minimum requirements for laboratory testing to ensure adequate wastewater treatment systems operation.

1. Definitions. Definitions as set forth in the Missouri Clean Water Law and 10 CSR 20-2.010 shall apply to the terms to be used in this rule, unless the context clearly requires otherwise.
2. Operational laboratory tests and related monitoring for wastewater treatment systems control shall be considered as a supplement to the National Pollutant Discharge Elimination System (NPDES) permit requirements. These monitoring reports to the department shall accompany NPDES discharge monitoring reports and shall be submitted at the frequency specified for NPDES discharge monitoring report submittal.
3. The department may modify required monitoring frequency required in this rule based upon the department's judgement of monitoring needs for process control at a specified facility.
4. These requirements for laboratory tests shall apply to all wastewater treatment systems owned or operated

by or for municipalities, public sewer districts or other local government entities, private sewer companies regulated by the Public Service Commission, and the state agencies or any subdivision of them, servicing population equivalents greater than two hundred (200) or with twenty-five (25) or more service connections. All other systems are exempt.

5. Minimum monitoring requirements to ensure adequate wastewater treatment systems in-plant operational control are as follows:

A. Lagoons

(All Types) Two (2)/Week Frequency.

Weather Conditions-Ambient temperature, cloud cover and precipitation

Flow	Influent or Effluent
pH	Primary Cell
D.O.	Primary Cell

B. Mechanical Plants

1. All types-daily frequency.

Weather Conditions-Ambient temperature and precipitation

Flow	Influent or Effluent
pH	Influent

Did You Know...

by Keith Phipps

As an operator for about 20 years, I was not aware of the requirements of 10 CSR 20-9.010. It was not until I came to work for Department of Natural Resources that I knew they existed. I thought that all we had to test for was on the permit. As luck would have it, we already did this monitoring for the most part and did not get in trouble. I just wanted to make other operators aware of these requirements, and they are to be included on the back of the Discharge Monitoring Report under Operational Control. In my opinion, this regulation requires operators to operate their plant by doing process control so they have time to make necessary adjustments before it reaches the effluent. These requirements are in addition to the requirements stated in your permit.

2. Additional laboratory test requirements for wastewater activated sludge processes and modifications:

Influent		Mixed Liquor
NFR	1/week	1/week (sample reaeration basin for contact stabilization)
Settle-		Daily (sample)

Division 20 – Clean Water Commission

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D.O. ability contact and re-aeration basins for contact stabilization)
Daily (sample contact and re-aeration basins for contact stabilization)

3. Facilities having digesters shall perform the following additional laboratory tests:

	Anaerobic	Aerobic
pH	Daily	-
Temperature	Daily (if heated)	-
D.O.		Daily

C. Facilities which chlorinate for disinfection shall perform total chlorine residual of the effluent on a daily basis during those periods when chlorination facilities are in use.

D. Facilities employing disinfection technology other than chlorine shall have disinfection process control testing parameters and frequency determined by the department on a case-by-case basis.

6. Laboratory procedures shall be performed according to the most cur-

rent edition of Standard Methods for the Examination of Water and Wastewater or other methods approved by the department.

7. All owners of wastewater facilities operated by or for municipalities, sewer and water districts or Public Service Commission (PSC) regulated sewer companies may complete a self-analysis of the wastewater utility each calendar year utilizing the Missouri Municipal Water Pollution Prevention (MWPP) survey forms supplied by the department.

Participation in this program is voluntary. For owners who have submitted an MWPP survey for the last five (5) consecutive calendar years; or for owners who have submitted an MWPP survey for every calendar year since the inception of the program, the department will-

A. Not impose administrative penalties until the process of conference, conciliation and persuasion (CC&P) as per 10 CSR 20-3.010 plus at least one (1) additional communication separated by at least ten (10) days from other

communications are completed by the department; and

B. Reduce any base penalty calculated as per 10 CSR 20-3.010(8)(B)6. by up to one-third (1/3) of the amount between the mid-point and least figure of the penalty range.

8. A copy of all reports required by this rule shall be retained by the facility for a minimum of three (3) years.

9. Penalties for violation of this rule shall be as provided in the Missouri Clean Water Law.

10. Severance. If a section, subsection, paragraph, subparagraph, part or subpart of these rules or any part of them be declared unconstitutional or invalid for any reason, the remainder of these rules shall not be affected and shall remain in full force and effect.

11. Effective Date. This rule becomes effective July 1, 1977, after adoption and compliance with the requirements of section 644.036.3. of the Missouri Clean Water Law and Chapter 536, RSMo.

Variations of the Activated Sludge Technology

Package plants are pre-manufactured treatment facilities used to treat wastewater. Usually designed to treat flows between 10,000 and 250,000 gallons per day, these are good choices for areas with a limited number of people and small wastewater flows. These plants are options for small communities or in such isolated locations as trailer parks, highway rest areas, hospitals and prisons. Some of the most common types of package plants use biological aeration processes: extended aeration, sequencing batch reactors and oxidation ditches.

Extended Aeration

The extended aeration process holds wastewater in an aeration tank for 18 hours or more and the organic wastes are removed under aerobic conditions. Air may be supplied by mechanical or diffused aeration. Mixing is by aeration or mechanical means.

This process operates at a high solids retention time (low F:M), resulting in a condition where nitrification may occur. The microorganisms compete for the remaining food. This highly competitive situation results in a highly treated effluent with low solids production.

The wastewater is screened to remove large suspended or floating solids before entering the aeration chamber, where it is mixed, and oxygen is added. The solids settle out and are returned to the aeration chamber to mix with incoming wastewater. The clarified wastewater flows to a collection channel before being diverted to the disinfection system.

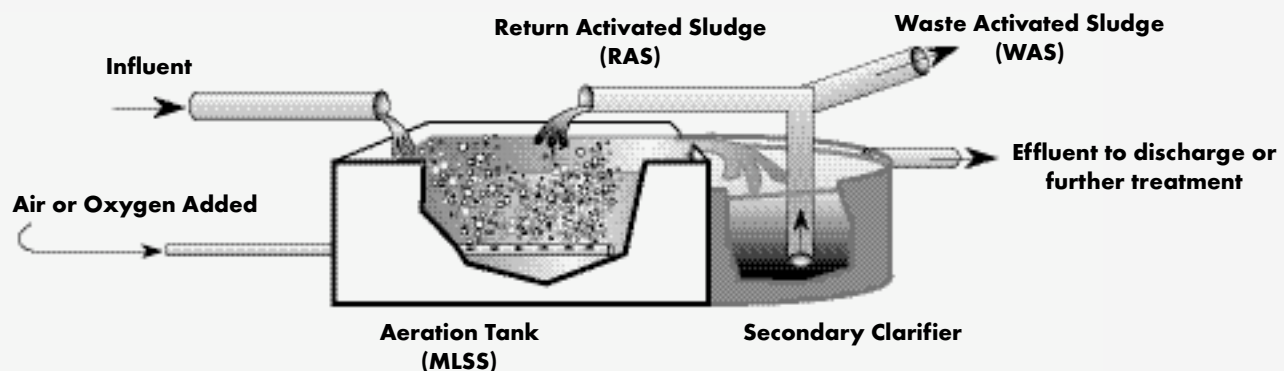
This is the process many package plants in schools, housing developments, and small communities use. Due to the light loading of food to microorganisms, extended aeration plants are considered

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Variations of the Activated Sludge Technology

(... continued from Page 2)

Figure 1 Typical Activated Sludge Process



one of the most stable wastewater treatment processes.

The extended aeration process can accept periodic (intermittent) loadings without upsetting the system. Extended aeration does not produce as much waste sludge as other processes; however, wasting still is necessary to maintain proper control of the process.

Sequencing Batch Reactors

The sequencing batch reactor (SBR) is considered a fill-and-draw activated sludge system. The processes of equalization, aeration and clarification are all achieved in the same tank, unlike a conventional activated sludge system, in which the same processes are accomplished in separate tanks. Wastewater is added to

the tank, treated to remove undesirable components, and then discharged.

SBR systems consist of five common steps carried out in sequence: (1) fill, (2) react (aeration), (3) settle (sedimentation/clarification), (4) draw (the effluent is decanted) and (5) idle. Sludge wasting usually occurs during the settling phase. The SBR acts as an equalization basin when filling with wastewater, enabling the system to tolerate peak flows or loads.

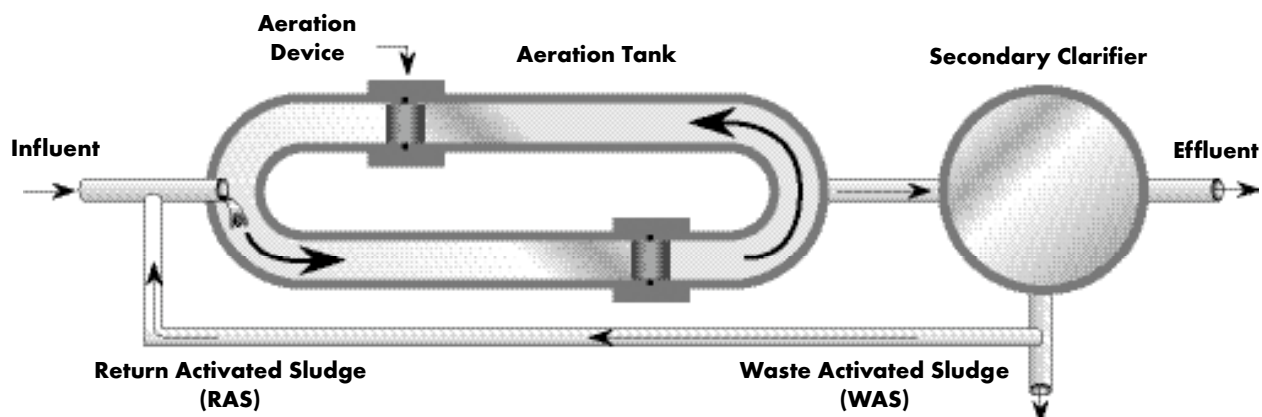
After passing through a screen to remove grit, the effluent enters a partially filled reactor. Once the reactor is full, it performs like a conventional activated sludge system without a continuous influent or effluent flow. Aeration and mixing are discontinued after the bio-

logical reactions are complete, the solids are allowed to settle, and the treated effluent (supernatant) is removed. Excess solids are removed at any time during the cycle.

SBRs are typically used where flowrates are five million gallons per day or less. Due to their relatively small footprints, they are useful in areas where available land is limited. In addition, it is easy to modify cycles within the system for nutrient removal if necessary. SBRs are also cost effective if treatment beyond biological treatment, such as filtration, is required. SBRs also offer a potential capital cost savings by eliminating the need for clarifiers.

(continued on Page 4 ...)

Figure 2 Oxidation Ditch



Variations of the Activated Sludge Technology

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SBRs require a sophisticated level of maintenance due to the timing units and controls. Depending upon the downstream processes, it may be necessary to equalize effluent after leaving the SBR.

Oxidation ditches

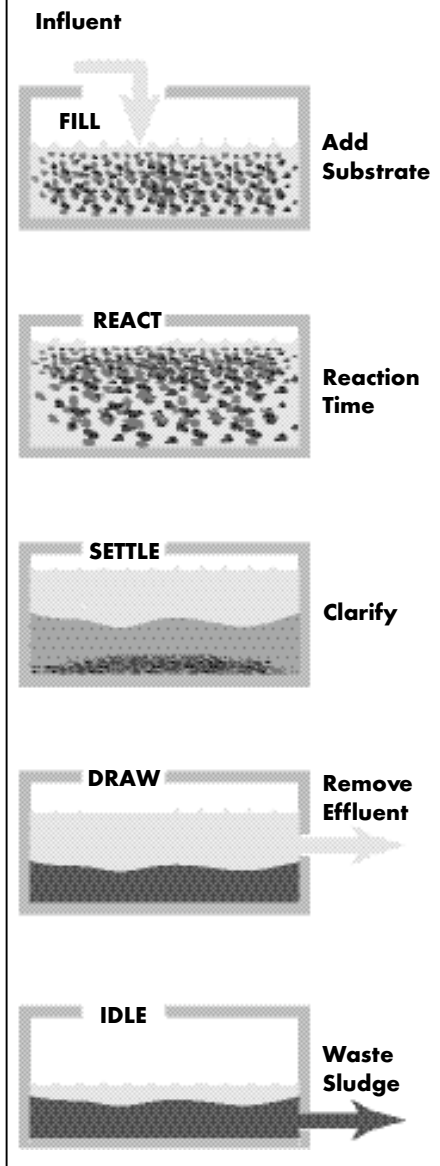
The oxidation ditch is an extremely effective variation of the activated sludge process, consisting of a ring or oval shaped channel equipped with mechanical aeration devices, such as brush rotors or disc aerators. Oxidation ditches typically operate in an extended aeration mode with long solids retention times. Solids are maintained in suspension as the mixed liquor circulates around the ditch. Preliminary treatment involves bar screens and grit removal. Secondary sedimentation tanks are used for most applications. Tertiary filters may be required after clarification and disinfection is required. Re-aeration may be necessary prior to final discharge.

Oxidation ditch process plants can be designed to achieve specific objectives including nitrification, denitrification, and/or biological phosphorus removal. And due to the constant water level and continuous discharge, oxidation ditch technology is very reliable and does not cause an effluent surge common to other biological processes, such as SBRs.

Oxidation ditches are more energy efficient than other similar processes, so this technology can be a good choice for small communities and isolated institutions over conventional treatment plants. But oxidation ditches require a larger land area which sometimes limits their use in areas where land costs are high.

Reprinted by permission of the National Small Flows Clearinghouse (NSFC), (800) 624-8301, West Virginia University, Pipeline newsletter, Spring 2003, Volume 14, Number 2. This article will be the first in a three part series.

Figure 3 Batch Reactor



Glossary

Activated sludge - sludge particles produced in wastewater by the growth of organisms in aeration tanks. The term 'activated' comes from the fact that the particles are teeming with bacteria, fungi and protozoa. Activated sludge is different from primary sludge in that the sludge particles contain many living organisms that can feed on the incoming wastewater.

Activated sludge process - a biological wastewater treatment process which speeds up waste decomposition. Activated sludge is added to wastewater, and the mixture is aerated and agitated. After a certain amount of time, the activated sludge is allowed to settle out by sedimentation and is disposed of (wasted) or reused (returned to the aeration tank)

Aerobic - condition where oxygen is present

BOD - biological oxygen demand. Measure of oxygen required by organic material in the water.

Bulking - sludge that forms clouds in the secondary clarifiers when the sludge does not settle properly, usually caused by filamentous bacteria

F:M - food to microbe ratio

Floc - clumps of bacteria

Flocculation - agitating wastewater to induce the small, suspended particles to bunch together into heavier particles (floc) and settle out.

Loading - a quantity of material added to the process at one time

MLSS - mixed-liquor suspended solids

MLVSS - volatile mixed-liquor suspended solids

Mixed liquor - activated sludge mixed with primary effluent (raw wastewater)

Package plant - pre-manufactured

treatment facility small communities or individual properties use to treat wastewater

SRT - Solids retention time

Sludge - The solids that settle out during the process

Supernatant - the liquid that is removed from settled sludge. It commonly refers to the liquid between the sludge on the bottom and the scum on the surface.

Wasting - removing

Wastewater Treatment Technician Wanted

Wastewater Treatment Technician - Jackson County, Mo. Assures wastewater disposal and installations conform to county codes and state and federal regulations. Requires bachelor's degree in environmental science or civil engineer-

ing or related field, or associate's degree in environmental science or civil engineering or related field or five years equivalent work experience. Must have a valid Missouri driver's license.

Submit resume/application to:

Jackson County Public Works Dept.
416 East 12th St., 9th Floor
Kansas City, Missouri 64106

Or e-mail:

willroc@jacksongov.org

Funding Available for Drinking Water Operators

Funding for drinking water training and certification fees is available to public drinking water systems serving populations of 3,300 people or less.

The Missouri Department of Natural Resources recently received a \$3.1 million drinking water operator expense reimbursement grant from the U.S. Environmental Protection Agency (EPA). The intent of the grant is to provide money for the training and certification of individuals operating community and non-transient non-community drinking water systems serving 3,300 people or less. More than 1,500 public water systems in Missouri are eligible for a portion of grant funds.

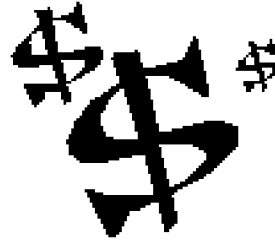
There is no application to receive these funds. Funds will be made directly

available to eligible systems in the form of vouchers. Vouchers are department-issued forms that can be used toward the costs of obtaining and retaining drinking water operator certification. Vouchers can be used as payment for:

- ◆ drinking water treatment and distribution training
- ◆ certification examinations
- ◆ certification fees
- ◆ renewal certifications fees

Any water system personnel may use a voucher; it is not necessary to be a certified operator.

The department is preparing to send vouchers to eligible systems this summer.



In May or June, the department will send information packets to all eligible water systems. These packets will contain more information about the grant and will explain how the voucher program will work.

A list of the eligible drinking water systems is provided at the following Web site:

www.dnr.mo.gov/oac/oprtrain.htm

For more information call 1-800-361-4827 and ask for the operator certification unit, e-mail opcgrnt@dnr.mo.gov or visit the Operator Certification page of the department's Web site at: www.dnr.mo.gov/oac/oprtrain.htm.

Asset Management Workshops Announced

It has been shown, most notably in Australia and New Zealand over the past 20 years, that asset management saves water and sewer systems 15 percent to 40 percent of their capital improvement and operating costs compared to conventional planning and construction.

An "average" system with operating costs of \$100,000 per year should save up to \$40,000 per year using asset management strategies. At that rate it will only take 25 to 70 systems adopting asset management to realize an annual savings of \$100,000,000.

This spring the Department of Natural Resources' Environmental Assistance Office will begin presenting asset management workshops around the state.

The workshops, designed for anyone who makes decisions that affect water and sewer systems and other infrastructure, will provide participants the information and strategies needed to start asset management programs.

What is asset management? The American Public Works Association defines asset management as "A comprehensive and structured approach to the long term management of assets as tools for the efficient and effective delivery of community benefits." It takes time and effort to develop an asset management program for a water or sewer system. However, doing it will produce remarkable benefits.

"Asset management has the potential of saving millions of dollars annually in Missouri," said Steve Mahfood, director of the Department of Natural Resources. "At the same time, those systems will perform better and be more reliable than if they were managed in the conventional way."

"There are more than 2,400 public water and sewer systems in Missouri," said Carl Brown, government assistance unit chief in the department's Environmental Assistance Office. "A few dozen systems adopting asset management strategies within a year or two is a very reasonable expectation. Actually, we hope a few

(continued on Page 6 ...)

Asset Management Workshops Announced

(... continued from Page 5)

hundred will do it. Longer term, we'd like a thousand."

Whatever the level of savings, asset management will translate into better performance and substantially reduced costs for the ratepayers of those water and sewer systems. When a system improves its performance and lower its costs, ratepayers can be expected to say volumes of good things.

Although they don't know it by the name "asset management," ratepayers understand and embrace the notion. To them it is simply getting the most bang for their buck, paid as rates or taxes.

For the systems themselves, asset management is an effective technique to find and implement best management practices. "Asset management is also a 'language' system managers can use to communicate to their ratepayers what needs to be done and what it will cost to provide the level of service ratepayers desire," Brown said. Thus, those managers who adopt asset management strategies won't need to drag ratepayers to system decisions. Instead, they will be

able to use asset management to lead ratepayers to good decisions. "Given good information, large groups of people generally make decisions that are in their best interest," he said. Asset management produces good, complete information for decision making.

The Department of Natural Resources has scheduled four asset management workshops around the state as follows:

- ◆ June 1 Kansas City -
 Discovery Center
- ◆ July 7 Kirkwood - Powder
 Valley Conservation
 Nature Center
- ◆ Aug. 8 Macon
- ◆ Sept. 29 Poplar Bluff

This schedule is subject to change. For the final schedule and location details, and to register for a workshop, call the Environmental Assistance Office at 1-800-361-4827 or visit the department's Web site at www.dnr.mo.gov/oac/lgov.htm. From the Web site scroll down to the Resource Management Institute link.

EMS Training and Implementation

The Missouri Department of Natural Resources is announcing a program of environmental management system (EMS) training and facilitated implementation. The program consists of quarterly workshops and individualized assistance. Between workshops, participants develop elements of the EMS with the object of completing an EMS manual by the end of the yearlong program. The classes will be June 15-16, Sept. 15-16, Dec. 8-9 and March 15-16, 2005. All of the sessions will be held at the Discovery Center in Kansas City. The program brochure is available on the Iowa Waste Reduction

Center Web site: <http://www.iwrc.org/programs/emsEPABrochure.pdf>.

Additional information, or a paper copy of the program brochure, is available through Daniela Heppard in the department's Environmental Assistance Office at 1-800-361-4827. Staff of the Environmental Assistance Office can also provide general information about the characteristics and benefits of EMS. Participants completing the four workshops and the EMS manual will receive 30 hours of training credit applicable to drinking water, distribution system, wastewater or CAFO renewals.

Department of Natural Resources Develops Resource Management Institute

The Department of Natural Resources has announced the roll-out of its Resource Management Institute (RMI). The asset management workshops are among several in the RMI series.

Environmental Issues for Government and Environmental Infrastructure, until this year known collectively as the Environmental Management Institute (EMI), are geared toward local government decision makers and managers. EMI has received high marks from participants through the years and a Governor's Award for Quality and Productivity in 1999.

The Show-me Ratemaker workshops teach participants how to fully use the Ratemaker programs, developed by the department, to analyze and adjust water and sewer rates. The Show-me Ratemaker programs are used by systems all over the United States. The primary developer of the programs, Carl Brown, and the primary user charge specialist for the department, David Kindelspire, have trained participants from more than 25 states in how to use the programs. They co-train the Ratemaker workshops in Missouri.

To learn more about local workshops in the RMI series and other local training opportunities call the Missouri Department of Natural Resources' Environmental Assistance Office at 1-800-361-4827 or visit the department's Web site at www.dnr.mo.gov/oac/lgov.htm and scroll down to the Resource Management Institute link.



Missouri Department of Natural Resources
Outreach and Assistance Center
P.O. Box 176 Jefferson City, MO 65102-0176

DOCUMENT DISTRIBUTION SERVICES

The following is a list of prices and training manuals that we currently stock:

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	381	AWWA's Water Distribution Operator Training Handbook	\$35.00	
	382	AWWA's Operator Certification Study Guide (Questions & Answers) A Workbook for Treatment Plant Operators & Distribution System Personnel	\$40.00	
	383	Laboratory Manual for Waterworks Operators	\$ 1.50	
		<i>California State University manuals-</i>		
	384	Water Treatment Plant Operation Volume I	\$45.00	
	385	Water Treatment Plant Operation Volume II	\$45.00	
	386	Small Water System Operation and Maintenance	\$45.00	
	387	Water Distribution System Operation and Maintenance	\$45.00	
	388	Operation of Wastewater Treatment Plants Volume I	\$45.00	
	389	Operation of Wastewater Treatment Plants Volume II	\$45.00	
	390	Advanced Waste Treatment	\$45.00	
	380	Manual of Instruction for Water Treatment Plant Operators (New York Manual)	\$16.00	
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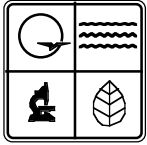
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